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Original Article

Association between lunar phase and sleep characteristics

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ABSTRACT

Objectives: Popular belief holds that the lunar cycle affects human physiology, behavior, and health, including sleep. To date, only a few and conflicting analyses have been published about the association between lunar phases and sleep. Our aim was to analyze the relationship between lunar phases and sleep characteristics.

Methods: In this retrospective, cross-sectional analysis, data from 319 patients who had been referred for sleep study were included. Individuals with apnea–hypopnea index ≥15/h were excluded. Sociodemographic parameters were recorded. All participants underwent one-night standard polysomnography. Associations between lunar cycle (new moon, full moon and alternate moon) and sleep parameters were examined in unadjusted and adjusted models.

Results: Fifty-seven percent of patients were males. Mean age for men was 45 ± 14 years and 51 ± 12 years for women. In total, 224 persons had their sleep study done during alternate moon, 47 during full moon, and 48 during new moon. Full moon was associated with lower sleep efficiency [median (%) (IQR): new moon 82 (18), full moon 74 (19), alternate moon 82 (15); $P < 0.001$], less deep sleep [median (%) (IQR): new moon 9 (9), full moon 6 (4), alternate moon 11 (9); $P < 0.001$], and increased REM latency [median (min) (IQR): new moon 98 (74), full moon 137 (152), alternate moon 97 (76); $P < 0.001$], even after adjustment for several covariables.

Conclusion: The results are consistent with a recent report and the widely held belief that sleep characteristics may be associated with the full moon.

1. Introduction

Human culture has been fascinated by the cycles of the moon [1]. Beliefs in lunar effects on sleep date back to ancient times. The passage from full to crescent moon provided the basis for the earliest calendars of most civilizations and can be linked to Assyrian and Babylonian mythology. Nevertheless, evidence for the supposed influence of the moon on human behavior has been particularly elusive. Surveys of workers in the mental health professions, however, show a persistent belief that the full moon may influence behavior [2,3].

The observations made by Galileo Galilei on the phases of the moon cycle remain correct in today's astronomical understanding. There are eight phases of the moon cycle, which succeed each other with a periodicity of 3.69 days: new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, last quarter, waning crescent. The synodic cycle is the interval between two successive new moons. This is the time it takes the moon to complete an orbit around the earth (29.53 days), corrected for the Earth's orbit around the Sun. Most studies associated with the influence of the moon on human behavior focus mainly on the full moon within the synodic cycle [4].

Several published reports suggest an association of the lunar cycle with women's menstrual cycle [5,6]. The lunar cycle also has been

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suggested to have an impact on fertility and births [7–9]. However, no significant effect of the lunar cycle on the number of deliveries was found in Austrian [10] and in American studies [11,12]. Several papers reported associations between the lunar cycle and the frequency of hospital admissions due to various causes such as cardiovascular disease [13], acute coronary events [14], gastrointestinal hemorrhage [15], and infectious diarrhea [16]. Lunar phases were also associated with the number of requests for appointment at a thyroid outpatient clinic [17]. On the other hand, a number of studies showed insufficient evidence or no association between various health-related events and the synodic lunar cycle [18–24]. Studies also showed that lunar periodicity may be associated with traffic accidents [25], crime [26], suicides, aggravated assaults, and psychiatric emergency room visits [7]. Little is known, however, about the association between the lunar cycle and sleep patterns.

Röösli et al. studied 31 volunteers and showed an association between lunar cycle and sleep characteristics. Subjective sleep duration was shortened and fatigue was increased at full moon. In contrast, sleep latency, wake-up events, level of distress, mood, and well-being were not associated with the lunar cycle [27]. A study monitoring wrist-activity showed no association between sleep duration and moon phase [28]. Lastly, the moon cycle had no effect on human daily rhythm, wake-up, and to-sleep times in four volunteers [29]. An analysis of diaries kept by 196 participants showed no association between full moon and dream recall [30]. However, a recent study involving 33 participants found that electroencephalogram (EEG) delta activity during non-rapid eye movement (NREM) sleep, an indicator of deep sleep, decreased by 30%, time to fall asleep increased by 5 min, and EEG-assessed total sleep duration decreased by 20 min around full moon [31].

In the present work, we analyzed the relationship of synodic lunar phases with subjective and objective sleep characteristics. Specifically, we wanted to test the hypothesis that full moon is associated with lower sleep efficiency and deep sleep. We also wanted to quantify the association of full moon and sleep latency. There is a strong link between sex and sleep both in the structure of sleep and in the incidence of various sleep disorders [32,33]. Accordingly, we sought to determine whether the association between the lunar cycle and sleep was different between the sexes.

2. Methods

2.1. Sample of patients and data collection

This retrospective, cross-sectional study was performed at the 1st Department of Internal Medicine, Semmelweis University, Budapest, Hungary. Data obtained from 319 consecutive patients, referred to the sleep laboratory for sleep studies, were analyzed between January 2007 and November 2009. Exclusion criteria included technical limitations, moderate and severe obstructive sleep apnea (OSA) [apnea–hypopnea index (AHI) $\geq$ 15/h], and sleep efficiency of <20%.

The ethics committee of the Semmelweis University had approved the study. Before enrollment, patients received detailed written and verbal information regarding the aims and protocol of the study and signed informed consent. Socio-demographic information (age, sex, level of education) and details of medical history were collected at enrollment.

2.2. Questionnaires

Participants completed a battery of validated questionnaires, including the Athens Insomnia Scale (AIS) (score range 0–24, with higher scores indicating worse sleep; a cut-off score of 10 was used to identify patients with clinically relevant insomnia [34]) and Center for Epidemiologic Studies–Depression (CES-D) Scale [35] (score range 0–60, with high scores indicating greater depressive symptoms; a cut-off score of 16 was used to estimate the frequency of potentially relevant depression in patients), Stanford Sleepiness Scale (SSS) [36], and subjective sleep log [37]. The Charlson Comorbidity Index (CCI) [38] was also tabulated.

2.3. Polysomnography

Standard, attended overnight polysomnography was performed in four acoustically isolated and video-monitored units in our sleep laboratory (SOMNOscreen™ PSG Tele, SOMNOmedics GmBH, Germany, CE0494). Tests were always done on weekdays, "lights off" and "lights on" times were uniform and were set at 21:00 and 06:00, respectively. Sleep architecture was characterized by the following parameters: sleep efficiency is the ratio of time spent asleep over the time spent in bed; sleep onset latency as time from lights out until sleep onset (defined as first epoch of stage 2); number of awakenings; arousal index as number of arousals per hour. The amounts of four different stages of NREM and REM sleep were determined as percentages of sleep period time (time from sleep onset until final awakening). Light sleep is the sum of stages 1 and 2; slow wave sleep or deep sleep is the combination of stages 3 and 4. Wake percentage is defined as the percentage of wake period from lights off to lights on. All recordings were scored visually per 30 s epochs by experienced scorers according to the criteria of Rechtschaffen and Kales [39].

2.4. Definition of sleep disorders

Apnea was defined as the absence of airflow for >10 s. Hypopnea was defined as a clearly discernible reduction in airflow for >10 s, associated with an arousal and/or reduction in oxygen saturation >3% [40]. OSA severity was defined by AHI, calculated as the number of apnea and hypopnea episodes per hour of sleep.

Periodic limb movements in sleep (PLMS) was defined by limb movement (LM) duration: 0.5–5 s with inter-movement interval: 5–90 s. A PLMS cycle consisted of at least four consecutive LMs. The periodic limb movement index (PLMI) was defined as the number of LMs per hour during sleep. PLMS was defined as PLMI $\geq$15 [41].

2.5. Statistical analysis

Statistical analysis was carried out using SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Data were summarized using proportions, mean ± standard deviation, or median (interquartile range: IQR), as appropriate. Data were analyzed using analysis of covariance (ANCOVA) or Kruskal–Wallis test, as appropriate. Sidac post-hoc analyses or Mann–Whitney test with Bonferroni correction was conducted to explore the differences of the sleep parameters between moon phase groups. The significance level was defined as $P < 0.05$.

Tests for interaction (ANCOVA) between sex and lunar phases were used to examine whether the association between sleep parameters and moon cycle is different between men and women. We investigated the association of lunar phases and objective sleep efficiency, light sleep percentage, deep sleep percentage, wake percentage, REM percentage, sleep latency, and REM latency. Skewed variables were square-root- or rank-transformed, as appropriate. Analyses were adjusted for several covariables reportedly associated with sleep characteristics: age [42], sex [33], smoking [43], coffee consumption [44], use of sleeping pills [45], regular exercise [46], CCI, and CES-D score [47].

Moon phase was determined using information from the Hungarian Astronomical Association sidereal calendar [48]. Data were analyzed in three ways: first, lunar phases were categorized into three groups: new moon, full moon, and alternate moon (waxing crescent, waxing gibbous, waning gibbous, and waning crescent).

Table 1
Characteristics of study participants.

Characteristics	Total population ($n = 319$)	New moon ($n = 48$)	Full moon ($n = 47$)	Alternate moon ($n = 224$)	P-value[a]
Age (mean ± SD)	47.8 ± 13.5	49.9 ± 13.9	50.4 ± 15.8	46.8 ± 12.9	0.165
Female, *n* (%)	144 (45.1)	24 (50.0)	21 (44.7)	99 (44.2)	0.767
BMI (mean ± SD) (kg/m^2)	28.2 ± 5.4	28.4 ± 5.0	29.7 ± 6.6	27.7 ± 5.1	0.593
Use of sleeping pills, *n* (%)	23 (8.3)	2 (4.2)	2 (4.3)	19 (8.5)	0.381
Coffee consumption, *n* (%)	158 (49.5)	15 (31.2)	19 (40.4)	124 (55.3)	0.917
Current smoker, *n* (%)	57 (17.8)	6 (12.5)	4 (8.5)	47 (20.9)	0.58
Shift worker, *n* (%)	10 (3.1)	1 (2.0)	1 (2.1)	8 (3.5)	0.179
Charlson Comorbidity Index (median [IQR])	1.0 [1]	1.5 [1]	1.0 [1]	1.1 [1]	0.280
CES-D score (median [IQR])	14.0 [16]	14.0 [10]	14.0 [15]	13.0 [16]	0.739
Educational level (%)					0.945
Less than high school diploma	27.2	12.5	24.1	30.0	
High school graduate	30.3	37.5	24.1	30.1	
Higher education/university	42.5	50.0	51.7	39.9	
Sleep disorders					
AHI, *n* (mean ± SD)	117 (9.3 ± 2.2)	13 (10.0 ± 2.1)	14 (8.2 ± 3.2)	90 (9.3 ± 3.3)	0.101
PLMI, *n* (mean ± SD)	114 (42.0 ± 28.4)	16 (34.2 ± 19.3)	15 (40.1 ± 35.1)	83 (44.1 ± 28.5)	0.860
AIS, *n* (mean ± SD)	95 (13.5 ± 3.5)	19 (12.7 ± 3.1)	10 (13.3 ± 3.4)	66 (13.4 ± 3.7)	0.510

SD, standard deviation; BMI, body mass index; IQR, interquartile range; CES-D, Center for Epidemiologic Studies Depression Scale; AHI, apnea hypopnea index; PLMI, periodic legs movement index; AIS, Athens Insomnia Score.
[a] Test for heterogeneity/homogeneity: Brown–Forsythe or Levene.

For sensitivity assessment, the analysis was repeated using three different cut-off points: (1) new/full moon and one day before and one day after; (2) new/full moon and two days before and after; (3) new/full moon and three days before and after.

3. Results

Five hundred and twenty-two consecutive patients' data were enrolled: two patients had sleep efficiency <20%, four recordings were excluded due to technical limitations, and 197 patients had mild/severe OSA. Thus, 319 patients were included in the final analysis.

The participant characteristics are presented in Table 1. The mean ± SD age of the study participants was 45 ± 14 years for men and 52 ± 12 years for women. The mean BMI was 28.2 ± 5.4 kg/m^2. Twenty-three individuals used sleeping pills. Mean sleep efficiency was 78.2%. The median (interquartile range) CCI was 1.0 (2.0).

One hundred and seventeen patients (36%) had mild OSA, mean AHI 9.3 ± 2.2; 114 (35%) had PLMS, mean PLMI 42.0 ± 28.4; 195 (29.7%) reported insomnia symptoms, mean Athens score 13.5 ± 3.5. There were no significant differences regarding age, sex, BMI, use of sleeping pills, coffee consumption, shift work, CCI, CES-D score, and sleep disorders in the study subgroups (Table 1).

Objective sleep parameters, recorded with polysomnography, showed significant associations with lunar phases (Table 2). Deep sleep ($P < 0.001$), wake ($P < 0.001$), and REM ($P = 0.002$) percentages were significantly different between the three groups. Post-hoc analyses revealed less deep sleep percentage [6.1 (4) vs 10.9 (9), $P < 0.05$] and REM percentage (10.1 ± 6.6 vs 13.9 ± 6.6, $P < 0.05$), and higher wake percentage (28.7 ± 12.3 vs 20.2 ± 12, $P < 0.05$) at full moon compared to alternate moon phases. Sleep efficiency was significantly shorter ($P < 0.001$), whereas sleep latency ($P = 0.001$) and REM latency ($P < 0.001$) were longer at full moon compared to the other two moon phases. The results were similar in our sensitivity analyses using the three cut-off points to define "full moon" specified in Methods (not shown).

These associations remained significant after adjusting for age, sex, smoking, coffee consumption, use of sleeping pills, and regular exercise. Most of these associations remained significant after adjustment for the CCI. Finally, adjustment for the CES-D score in the final model did not abrogate the significant associations for deep sleep, wake percentage, sleep efficiency, and REM latency.

The interaction between sex and lunar phases was significant for deep sleep ($P = 0.01$) and sleep latency ($P = 0.01$), and, in general, the observed differences in the variables of interest were consistently more pronounced in women (Table 3). Interestingly, none of

Table 2
Polysomnographic sleep variables.

Sleep parameter	New moon	Full moon	Alternate moon	Unadjusted *P*	Adjusted model *P*[a]	Adjusted model *P*[b]	Adjusted model *P*[c]	Post-hoc
Light sleep (%)	56 ± 9.9	54.9 ± 9.1	54.2 ± 10.6	0.500	0.298	0.499	0.165	
Deep sleep (%)	8.8 [9]	6.1 [4]	10.9 [9]	<0.001	<0.001	<0.001	0.002	F < A
Wake (%)	21.9 ± 11.4	28.7 ± 12.3	20.2 ± 12	<0.001	0.004	0.004	0.024	F > A
REM sleep (%)	13.1 ± 5.8	10.1 ± 6.6	13.9 ± 6.6	0.002	0.046	0.100	0.117	F < A
Sleep efficiency (%)[d]	82.3 [18]	73.7 [19]	82.2 [15]	<0.001[e]	0.001	0.002	0.004	F < A, F < N
Sleep latency (min)[d]	12.1 [14]	24.5 [31]	13.3 [19]	0.001[e]	0.009	0.010	0.077	F > N, F > A
REM latency (min)	98 [74]	137 [152]	97.5 [76]	0.001	0.015	0.034	0.040	F > N, F > A

REM, rapid eye movement; F, full moon category; A, alternate moon category; N, new moon category.
Values are mean ± standard deviation or median [interquartile range].
Analysis of covariance (ANCOVA) was performed on the transformed variables, but untransformed means are reported for interpretability; for ANCOVA, post-hoc tests were performed with multiple test correction according to the Sidac method. $P < 0.05$.
[a] Age, sex, smoking, coffee consumption, use of sleeping pills, regular exercise.
[b] Also adjusted for Charlson Comorbidity Index.
[c] Also adjusted for Center for Epidemiologic Studies Depression Scale score.
[d] Variables were rank transformed.
[e] Kruskal–Wallis test, post-hoc tests were performed with Mann–Whitney tests with Bonferroni correction ($P < 0.0167$).

Table 3
Polysomnographic sleep variables by sex distribution.

Sleep parameter	Sex	New moon	Full moon	Alternate moon	P	Post-hoc	Adjusted model P[a]	Adjusted model P[b]	Adjusted model P[c]
Light sleep (%)	F	55.6 ± 9.1	56 ± 9.7	51.9 ± 9.3	0.04		0.108	0.315	0.103
	M	56.4 ± 10.8	53.8 ± 8.9	56.3 ± 11.1	0.541		0.797	0.807	0.551
Deep sleep (%)	F	6 [10]	6.1 [3]	13.5 [10]	<0.001	N < A, F < A	<0.001	<0.001	0.003
	M	9.6 [7]	6.5 [4]	9.4 [7]	0.180		0.328	0.409	0.297
Wake (%)	F	24.9 ± 10.4	30.5 ± 10.2	20.9 ± 11.5	0.001	F > A	0.006	0.005	0.161
	M	18.8 ± 11.8	27.2 ± 15.4	19.7 ± 12.3	0.013	F > A	0.167	0.176	0.117
REM (%)	F	11.7 ± 5.6	7.6 ± 5.6	14.12 ± 6.4	<0.001	F < A	0.003	0.012	0.118
	M	14.6 ± 5.7	12.1 ± 6.7	13.7 ± 6.8	0.409		0.904	0.936	0.517
Sleep efficiency (%)[d]	F	77.4 [17]	65.5 [28]	81 [16]	0.001[e]	F < A	0.002	0.001	0.053
	M	84.7 [19]	75 [18]	83.1 [14]	0.011[e]	N > F, F < A	0.148	0.165	0.056
Sleep latency (min)[d]	F	18 [18]	28 [23]	14.4 [18]	<0.001[e]	N < F, F > A	0.012	0.01	0.363
	M	8.6 [11]	17.2 [27]	10.9 [19]	0.060[e]		0.05	0.076	0.189
REM latency (min)	Females	120.5 [89]	177.5 [129]	104 [87]	0.001	N < F, F > A	0.077	0.295	0.291
	Males	81 [66]	122.5 [141]	90.2 [72]	0.075		0.082	0.042	0.072

REM, rapid eye movement; N, new moon category; F, full moon category; A, alternate moon category.
Values are mean ± standard deviation or median [interquartile range].
Analysis of covariance (ANCOVA) performed on the transformed variables, but untransformed means reported for interpretability; for ANCOVAs, post-hoc tests were performed with multiple test correction according to the Sidac method. $P < 0.05$.
[a] Age, sex, smoking, coffee consumption, use of sleeping pills, regular exercise.
[b] Also adjusted for Charlson Comorbidity Index.
[c] Also adjusted for Center for Epidemiologic Studies Depression Scale score.
[d] Variables were rank-transformed.
[e] Kruskal–Wallis test; post-hoc tests were performed with Mann–Whitney tests with Bonferroni correction ($P < 0.0167$).

the assessed sleep parameters (neither subjective nor objective) was associated with pre- or postmenopausal status in this sample (not shown).

Subjective sleep-related parameters were not significantly different between the three groups (Table 4). Within sex strata, however, the self-reported sleep onset latency was longer at full moon in women [median (IQR): new moon 30.0 (25) min, full moon 52.5 (66) min, alternate moon 25.0 (50); $P = 0.04$], and the difference was nearly significant among men [median (IQR): new moon 30.0 (45) min, full moon 60.0 (76) min, alternate moon 30.0 (45) min; $P = 0.06$].

4. Discussion

In this cohort of patients undergoing diagnostic polysomnography, full moon was associated with less deep sleep, lower sleep efficiency, and longer REM latency. This association seemed to be more pronounced in women than in men. Our study enrolled patients referred to a sleep clinic, thereby extending previous observations regarding the association between lunar cycle and sleep variables to a clinical population with potential sleep disorders.

A few earlier studies offered support for an association between the lunar cycle and human behavior [7], but others found no association [24].

One recent study reported similar results to those presented here: around full moon, deep slow-wave sleep was decreased [31]. Our study also found less deep sleep at the time of full moon, compared to other lunar phases.

Table 4
Subjective sleep characteristics.

Total population	New moon	Full moon	Alternate moon	P
Subjective sleep onset latency (min)	30 [40]	40 [70]	30 [45]	0.10
Subjective sleep time (h)	6 ± 1.7	5.9 ± 1.1	5.3 ± 1.6	0.43
Stanford Sleepiness Scale	2.6 ± 1.1	2 ± 1.4	2.5 ± 1.1	0.70
Morning fatigue	3.2 ± 1.2	2.8 ± 1.3	2.6 ± 1.2	0.59

Values are median [interquartile range] or mean ± standard deviation (analysis of variance).

Two previous studies reported that people slept on average 20 min less during nights with full moon compared with new moon [27,31]. In our analysis, we controlled for important covariates, including comorbidity and depressive symptoms, and the lunar phase remained independently associated with sleep efficiency. Similar to our results, Cajochen et al. also reported a longer sleep latency and decreased slow-wave sleep around full moon compared to other lunar phases [31]. They also found reduced sleep quality and total sleep time 0–4 days around the full moon. In our study, participants had been referred to a sleep center because of clinical suspicion of sleep disturbances, whereas the previous study enrolled healthy volunteers. The results overall are similar, suggesting that the observed associations might be present in subjects with sleep disorders as well as in normal sleepers [31].

The exact mechanism for the association between lunar cycle and sleep remains unclear, and additional studies are needed to confirm these findings and to identify potential mechanisms. Several potential mechanisms may be considered. When the moon is full, the earth is between the sun and the moon. It cannot be excluded that the change in the electromagnetic radiation and/or the gravitational pull of the moon during this phase may influence the release of neurohormones or neural activity [7]. Several observations suggest that the lunar tidal force affects certain biochemical processes [49]. A few studies have evaluated circalunar patterns of seizure occurrence [50,51]. Furthermore, transcranial magnetic stimulation initiates EEG slow-wave activity in sleeping volunteers, suggesting that electromagnetic exposures may influence brain activity and sleep characteristics [52]. Thus, the solar radiation reflected by the full moon [53] and the lunar tidal force might modify brain activity.

A nocebo effect is also possible, meaning that people tended to go to bed later during full moon because they expected to sleep less well, knowing that it was full moon [27]. However, we believe that this was unlikely to influence our results since people living in large cities are less likely to be aware of the lunar cycle, and the majority of the study participants lived in the capital of Hungary. Furthermore, neither the patients nor the personnel were aware of our planned analyses of the lunar cycle. Finally, our sleep suites had no windows; therefore, there is little chance that expectations related to the full moon modified our results.

An association between lunar phase and sleep might be explained by circalunar periodicity of serum hormone levels. Some animals are clearly influenced by the moon and possess internal clocks that follow the lunar cycle [54–56]. In humans, circalunar hormone cycle has been observed in both women (menstrual cycle rhythmicity) and men [57]. Celec et al. found a circalunar cycle of salivary testosterone and visual–spatial performance in young healthy volunteers of both sexes [58]. Cajochen et al. suggested that the observed rhythm in sleep variables represents a circalunar rhythm property, running in synchrony with the lunar phases, reminiscent of other endogenous rhythms such as the circadian and circannual rhythms [31]. And as previously mentioned before, there is a strong link between female sex hormones and sleep [32]; female reproductive steroids appear to be involved in the cardiac autonomic control during sleep in women [59]. This implies the existence of sex differences in the structure of sleep, as well as in the association between lunar phases and sleep. We did not measure hormone levels in our participants; nevertheless our results suggest an increased sensitivity in women to lunar phases.

In earlier times, before modern lighting, the light of a full moon could have kept people up at night, leading to sleep deprivation and consequent psychological issues, according to a hypothesis that awaits experimental support [60]. However, as Rotton et al. pointed out, the moon is a relatively minor source of light in the present, therefore human behavior would be much more erratic if it were affected by light levels of this magnitude [61].

Our multivariable adjusted models suggest that comorbidity and depressive symptoms are associated with sleep, as reported previously [47]. The association of full moon with sleep efficiency and other sleep parameters remained significant after correcting for depression and comorbidity, and thus it is unlikely that these factors could explain our findings.

One of the strengths of our work is the relatively large sample with polysomnography data. Neither the patients, nor the personnel in the sleep laboratory were aware of our planned analysis, thus avoiding confounding by self-fulfilling prophecy the a lunar influence on sleep. We adjusted for several potential confounding covariates and analyzed the sex interaction. We excluded the effect of light, and everyone slept under standard circumstances – bedtime and wake-up time were a similar for all patients.

The retrospective, cross-sectional design prevented us from detecting the temporal change in sleep characteristics as a function of the moon cycle in a within-subject design. Second, we enrolled individuals referred to a sleep clinic for assessment; therefore the sample was not representative of the healthy general population. The fact that these participants had clinical suspicion of sleep problems might have made them more sensitive to the lunar cycle. Another limitation of this study is the absence of a normal control group and hormonal profile measurements.

If other studies confirm our findings, we believe this could potentially influence clinical practice. We do ask patients during a comprehensive sleep evaluation not only about their health but also about “environmental factors” affecting their sleep (noise, light, etc.). We consider pain, disturbing bed-partners or other potential interferences, both internal and external, when assessing sleep. In the same framework, we could include the lunar effect as a potential factor. If we detect that an individual is sensitive to the effects of moon phases, this could be explained to the patient, and it could be considered during the treatment. Patients could be prepared for this effect, for example in terms of sleep-related expectations.

5. Conclusion

The main result of this cross-sectional study is that there is an association of moon phases with both subjective and objective sleep parameters. Full moon was associated with significantly reduced sleep efficiency and other sleep parameters; therefore, we propose that lunar phases may contribute to the complex regulation of sleep, especially in women. Accordingly, poor sleep, the consequent emotional lability, and reduced daytime functioning may be partially related to the full moon.

Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: http://dx.doi.org/10.1016/j.sleep.2014.06.020.

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